MISCELLANEA ZOOLOGICA HUNGARICA

Tomus 5. 1989. p. 13—19

Ceratozetes gracilis (Michael, 1884) (Acari: Oribatida), an intermediate host of Vampirolepis asymmetrica (Janicki, 1904) (Cestoda: Hymenolepididae)

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(Received February 9, 1989)

ABSTRACT. A case of larval occurrence of Vampirolepis asymmetrica (Janicki, 1904) in an oribatid mite Ceratozetes gracilis (Michael, 1884) found in the Bükk National Park, Hungary is reported. A discussion of previous reports of the cysticercoids of V. asymmetrica and V. straminea (Goeze, 1782) is presented. Scolex-morphology of adult V. asymmetrica and V. straminea based on Hungarian material.

KEY WORDS: Cysticercoid of Vampirolepis asymmetrica (Cestoda), morphology, intermediate host: Ceratozetes gracilis (Oribatida), life cycle.

Only a few data are available about the life cycle of Hymenolepididae species parasitizing small rodents in Europe. PROKOPIČ et al. (1962, 1966, 1969, 1970, 1972) in Czechoslovakia reported the cysticercoids of two Vampirolepis species from oribatid mites: Achipteria coleoptrata (Linné, 1758) and Scheloribates laevigatus (C. L. Koch, 1836) both under natural condition and in laboratory experiences. In the course of compex zoological studies of the Bükk National Park, North-Hungary, we found a mite species infested with the cysticercoid of V. asymmetrica In this case we confirm, that for V. asymmetrica oribatid mites serve as intermediate hosts; and we are able to elucidate the probably erroneous statement, that the intermediate hosts of V. straminea (Goeze, 1782) are mites.

RESULTS

Cysticercoid of Vampirolepis asymmetrica (Janicki, 1904)

Intermediate host: Ceratozetes gracilis (Michael, 1884)

Locality: Bükk-plateau near of Jávorkút, Bükk National Park moss sample from the side of a sink, 900 m a.s.l., collected by S. MAHUNKA, 16 June, 1982: No BNP - B - 20, HNHM.

Localization of the cysticercoid: abdominal cavity.

Prevalence: 1%.

Intensity: one specimen.

Material preserved in 70% isopropyl alcohol; studied in lactophenol.

Description: The egg-shaped cysticercoid encapsulated lying in the rigth side of abdominal cavity of mite, length 0.170 mm, width 0.140 mm. Cyst wall elastic, 0.01-0.012 mm thick and consists of four layers. The cyst encloses a scolex with four suckers, rostellum and rostellar hooks the same as in the adult worm: V. asymmetrica. Diameter of the round scolex 0.11 mm, the suckers 0.06 mm in diameter, rostellum 0.05 x 0.06 mm with one circle of hooks. Number of rostellar hooks 22, 0.020-0.021 in length and 0.018 mm at the base. Form of the hooks are the same as in V. asymmetrica (see Figs 1 and 8).

Comparative material: Adult specimens of V. asymmetrica from the Bükk National Park

Definitive hosts: Pitymys subterraneus De Selys-Longchamps, 1836 and Microtus arvalis Pallas, 1779*

Localities: Bélapátfalva, 21 June, 1982; Bükkszentkereszt-Rejtek, 7 May, 1985; Nagyvisnyó, 24 June, 1984; Szilvásvárad, 21 June, 1984, collected by F. MÉSZÁROS and É. MURAI.

Localization: in the small intestine.

Prevalence: Two specimens of the 41 M. arvalis examined (5%) and twenty-two of the 67 P. subterraneus (33%) were infested with V. asymmetrica.

Intensity: 1-10 specimens (more than 50 specimens were available).

Material fixed and preserved in 5% formaline, worms stained with alum-carmine, hooks studied in Berlese medium.

To verify the identity of cysticercoid, found in oribatid mite, the morphological and metrical data of V. asymmetrica (adult worms) in the Bükk National Park are presented.

Description: Length 36-95 mm, maximal width 23 mm, diameter of scolex 0.21-0.27 mm. The four suckers measure 0.063-0.093 mm in diameter. Rostellar sack 0.075 x 0.10 mm, rostellum 0.034-0.060 mm in diameter; number of rostellar hooks varies between 19-24; length of the hooks 0.021-0.023 mm, at the base 0.018-0.022 mm. The form of the rostellar hooks is shown in Figs 3, 9. The most important characters of strobila: three testes in one line or in triangle, cirrus spinose, eggs spherical 0.045-0.065 mm in diameter, embryonal hooklets 0.009 mm in length (Fig. 4). The morphology of V. asymmetrica population is the same as in our previous investigations in the Carpathian Basin (MÉSZÁROS and MURAI, 1979; MURAI, 1974; TENORA and MURAI, 1972; TENORA and MURAI, 1976).

Adult specimens of Vampirolepis straminea (Goeze, 1782) syn. V. microstoma (Dujardin, 1845)

Because PROKOPIČ (1962) described an oribatid mite as intermediate host of V. straminea, we give the measurements and some morphological data of V. straminea in Hungary.

A) V. straminea in hamster - Cricetus cricetus Linné, 1758

Localities: The Great Hungarian Plain; Békéscsaba, Balmazújváros, Csárdaszállás, Debrecen, Hajdúszoboszló, Kaba, Katymár, Madaras, Mezőkövesd, Murony, Tiszavasvári; collected by G. CSORBA, B. EDELÉNYI, Zs. KALOTÁS, A. LEGÁNY, I. MATSKÁSI, F. MÉSZÁROS, É. MURAI, J. RÉKÁSI and I. SZABÓ, in the years 1966-1985.

Localization: Small intestine.

Prevalence: 30% (from 307 C. cricetus examined 63 were infested with V. straminea in Békés and Hajdú-Bihar counties).

Intensity: 2-30 specimens in one host.

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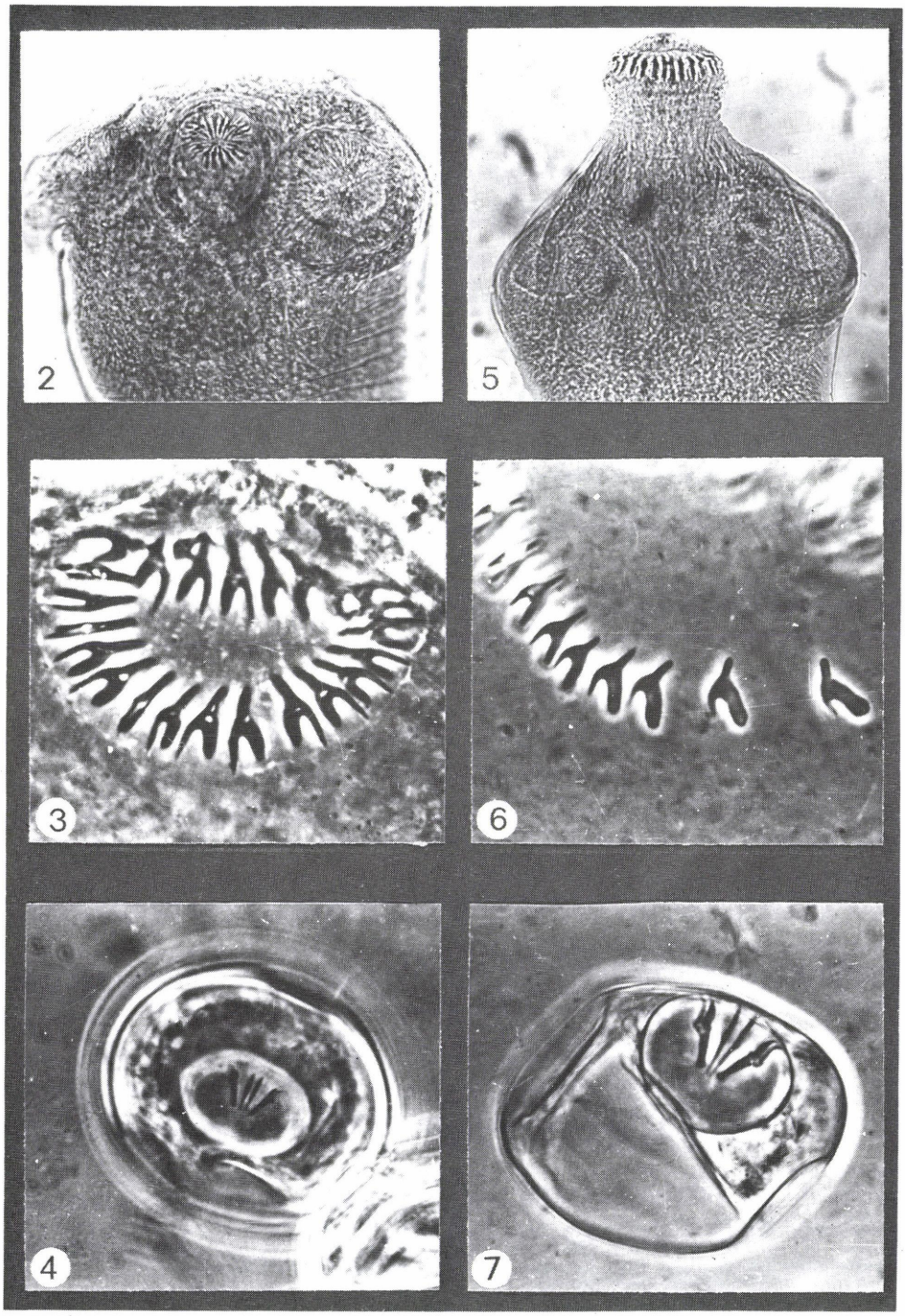
*98 specimens of the third potential host of V. asymmetrica, Clethrionomys glareolus (Schreber, 1780) were investigated, but none of them was infested with V. asymmetrica in this territory.

Fig. 1. Cysticercoid of Vampirolepis asymmetrica in an oribatid mite Ceratozetes gracilis (Bükk National Park)

Figs 2-4. V. asymmetrica (2= scolex; 3= rostellar hooks; 4= egg) from Pitymys subterraneus (Bükk National Park)

Figs 5-7. V. straminea (5= scolex; 6= rostellar hooks; 7= egg) from Cricetus cricetus (Tiszavasvári) (Figs 1, 2, 5 author's photo; Figs 3, 4, 6, 7 photo B. LOVAS).

1


2
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B) V. straminea in the mouse - Mus musculus spicilegus Petényi, 1882
(first record from Hungarian murids)

Locality: Nagykovácsi, Buda Hills, 350 m a.s.l., 6 September, 1977 (No. 7602-HNHM); 1 December, 1980 (No. 9098-HNHM); 18 March, 1985 (No. 10253-HNHM), collected by L. ZOMBORI.

Localization: biliary duct and small intestine; old proglottides in the end part of intestine.

Prevalence: 1.8% (in the Nagykovácsi population, among 176 mouse examined three were infested with V. straminea).

Intensity: 1-3 specimens.

Material fixed and preserved in 5% formalin, stained with alum-carmine or hydrochloric-carmine; rostellar hooks and eggs were studied in Berlese solution.

Description: V. straminea specimens from both host species from Hungary show the following characters:

Strobila 70-120 mm long, 1.8-2 mm wide. Scolex 0.19-0.28 mm, four suckers 0.07-0.10 mm in diameter. Rostellar sac measures 0.1 x 0.18 mm, rostellum 0.06-0.07 mm in diameter, with one circle of cricetoid hooks. Number of hooks varies from 21 to 28, length of rostellar hooks 0.013-0.014 mm, at the base 0.014-0.016 mm (Figs 10 and 11). The three testes situated triangularly. Cirrus has no spines on its surface. Ripe eggs ovoid 0.056 x 0.088 mm or spherical 0.070 x 0.080 mm, oncosphera 0.027 x 0.038 mm to 0.031 x 0.036 mm. Embryonal hooklets greater than rostellar hooks, 0.017-0.018 mm in length (Fig. 7).

SYSTEMATICS

The taxonomic status of the two Hymenolepis s.l. Weinland, 1858 species mentioned above has been changed several times in the last forty years (BAER and TENORA 1970; PROKOPIČ 1970 and 1972; SPASSKY 1954). In the latest identification key for tapeworms (SCHMIDT, 1986) both Hymenolepis asymmetrica (Janicki, 1904) and H. straminea (Goeze, 1782), as well as H. microstoma (Dujardin, 1845) which morphologically identical with H. straminea (see BAER and TENORA 1970 and the new material from Hungary), are recorded in the genus Vampirolepis Spassky, 1954. We used this new nomenclature; and V. microstoma (Dujardin, 1845) is considered as a synonym of V. straminea (Goeze, 1782).

BAER and TENORA (1970), TENORA and MURAI (1970,1972) redescribed both V. asymmetrica and V. straminea. Based on our own material we elucidate the most important morphological differences between the two species. Not only the number and form of rostellar hooks but the cirrus morphology and the eggs are typical. The cysticercoid of both species are alike, the invaginated scolex and the rostellar hooks show the specific characters:

- Number of rostellar hooks 18-24, length of hooks 0.021-0.023, at the base 0.018-0.020 mm ..... V. asymmetrica
- Number of rostellar hooks 21-28, length of hooks 0.013-0.015, at the base 0.014-0.016 mm ..... V. straminea

In the adult worms:

- Cirrus spinose; eggs spherical 0.045-0.065 mm in diameter; embryonal hooklets 0.008-0.010 mm in length ..... V. asymmetrica
- Cirrus withouth spines; eggs ovoid or spherical, 0.075-0.088 mm in diameter; embryonal hooklets 0.016-0.019 mm (longer than rostellar hooks) ... V. straminea

NOTE.

Both species have rostellar hooks from cricetoid type: handle is short. In other Vampirolepis species with hooks about 15-20 µm in length, the hooks are from fraternoid type, where the handle is the half of the hook-length.

DISCUSSION

Vampirolepis asymmetrica is a common parasite in Arvicolidae species in Europe. In the Carpathian Basin our work-team found it in Arvicola terrestris Linné, 1758; in Microtus arvalis Pallas, 1779; M. agrestis Linné, 1761; M. nivalis Martins, 1842; Pitymys subterraneus De Selys-Longchamps, 1836; P. tatricus Kratochvil, 1952; as well as in Clethrionomys glareolus Schreber, 1780. Many authors documented with figures and with the exact measurements of morphological features, that this parasite is spread all over Europe (BAER and TENORA 1970; FELIU, GISBERT and REY 1985; GENOV 1984; JOYEUX and BAER 1936; MÉSZÁROS and MURAI 1979; MURAI 1974; TENORA and MURAI 1972, 1976; and so on). ERHARDOVÁ (1955) described a new species: Hymenolepis ampla from Microtus nivalis in the High-Tatra Mountains, but this species is synonymous with V. asymmetrica (BAER and TENORA 1970). PROKOPIČ (1970a, 1970b, 1970c, 1972) and PROKOPIČ and MAUER (1969) recorded the occurrence of V. asymmetrica at many localities in Czechoslovakia. They found it not only in microtid hosts but in Apodemus species, too. These papers contain neither descriptions nor illustrations, and are used for ecological studies.

Considering the life cycle of cestodes parasitizing small mammals PROKOPIČ (1970a, 1972) and PROKOPIČ and MAUER (1969) described oribatid mites as intermediate hosts of V. asymmetrica (and of V. straminea, see afterwards). This succesful experimental infestations of mites with the eggs of V. asymmetrica elucidated the life cycle of this species. Two mite species served as intermediate hosts in laboratory: Scheloribates laevigatus (C. L. Koch, 1836) and Achipteria coleoptrata (Linné, 1758). We found Ceratozetes gracilis (Michael, 1884) naturally infested with V. asymmetrica cysticercoid.

PROKOPIČ (1962, 1966, 1970a, 1972) and PROKOPIČ and MAUER (1969) recorded the cysticercoid of V. straminea from oribatid mites and the adult worms from various rodents (five Arvicolidae, three Muridae and one Cricetidae species). In PROKOPIČ (1962) a detailed description, 5 figures and 3 photographs were given. The cysticercoid were found in naturally infested oribatid mite: Achipteria coleoptrata. Eggs of adult worms from Microtus arvalis were used in laboratory experiments. This paper provides us with sufficient documentation; however we must note, that the photographs, the measurements of the rostellar hooks, as well as the short description are not characteristic of V. straminea, but exactly of V. asymmetrica. The cysticercoids mentioned above with 18-22 rostellar hooks, 0.018 mm in length, the definitive host, and the morphology of adult worms are identical with V. asymmetrica. This is why we did not accept oribatid mites as intermediate hosts of V. straminea.

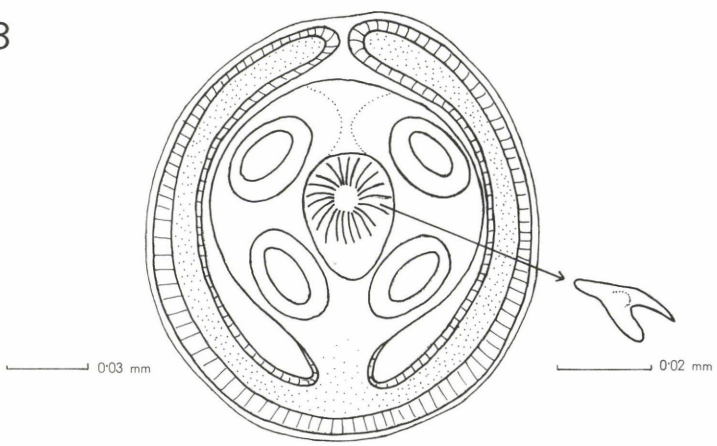


Fig. 8. Cysticercoid of V. asymmetrica (orig.)

The life cycle of V. straminea (before 1970 H. microstoma) is well-known, and used in laboratory technique for physiological experiments. White mice, rats or hamster are the definitive hosts and beetles (Tenebrio molitor, Tribolium castaneum etc.) serve as intermediate hosts. Cysticercoids of V. straminea was recorded from various insects: Coleoptera Siphonaptera, Orthoptera - in France, Germany, Switzerland, Spain under natural conditions. Succesful experimental infestations with specimens erected from Apodemus spp. were also reported (JOYEUX and BAER 1936; HUNKELER 1974; VAUCHER and HUNKELER 1967; WAHL 1967 and so on).

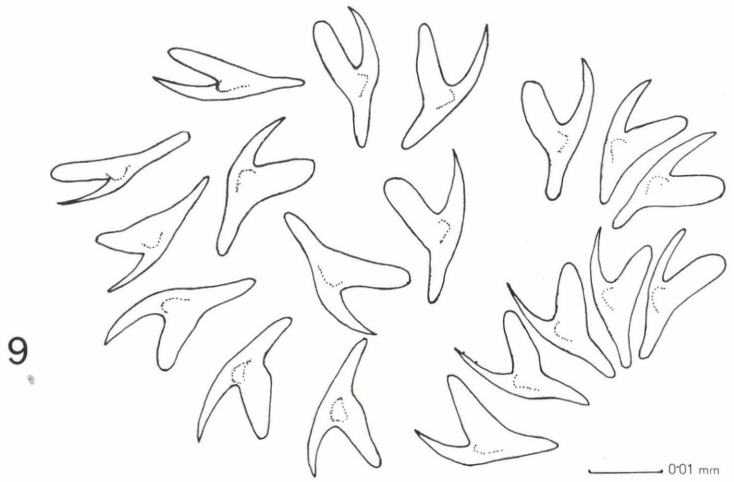
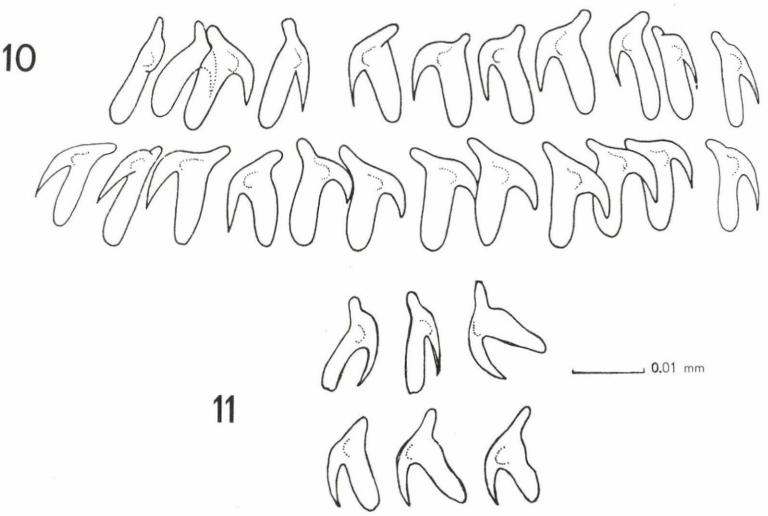


Fig. 9. Rostellar hooks of V. asymmetrica from P. subterraneus (Bükk National Park, orig.)



Figs 10-11. Rostellar hooks of V. straminea
(10= hook crown from Cricetus cricetus, Mezőkövesd; 11= form of rostellar hooks from Mus musculus spicilegus, Nagykovácsi, orig.)

V. straminea parasitizes Cricetus cricetus in Eastern Hungary at a high density, and sometimes occurs in Mus musculus spicilegus in Western Hungary. In Mus musculus and Rattus spp. it has a cosmopolitan spreading (and also in laboratory animals). In Europe under natural conditions definitive hosts are Muridae and Cricetidae species: Apodemus agrarius, A. flavicollis, A. sylvaticus, Micromys minutus, Mus musculus and ssp., Rattus norvegicus and R. rattus, Cricetus cricetus, C. frumentarius, Cricetulus migratorius, Mesocricetus auritus (BAER and TENORA 1970; ERHARDOVÁ 1955; FELIU 1980, FELIU, MAS-COMA and MURAI 1985; GENOV 1984; JOYEUX and BAER 1936; TENORA and MURAI 1970; VAUCHER and HUNKELER 1967; WAHL 1967). In Africa BAER and HUNKELER registrated V. straminea from Mus, Mastomys, Arvicanthis, Uranomys and Dendromus species (HUNKELER 1974). BAER and TENORA (1970) presented a detailed list of synonyms and made some corrections of faunistical data in Czechoslovakia. The authors cited in this paper, accepted their opinion after 1970, but the occurrence of V. straminea in Arvicolidae species, appears in recent literature (e.g. FELIU 1980). We propose, that the host-spectrum of V. straminea in this questionable group should be revised.

ACKNOWLEDGEMENTS

We are very grateful to Prof. Sándor MAHUNKA for he has concerned the tapeworm larvae occurring in mites during his studies. For the present study he found important evidence of the life-cycle of Vampirolepis asymmetrica. Many thanks to Dr. Lajos ZOMBORI, hymenopterologist, who has collected Mus musculus specimens for parasitological studies around his house in the Buda Hills for years. With his help we could prove the occurrence of Vampirolepis straminea, as a parasite of Muridae species, for the first time from the Hungarian fauna. We wish to thank Prof. Béla LOVAS for his kind assistance with the photographs.

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